detecting, imaging, and treating of tumors; tomographic imaging of organs; monitoring of organ functions; performing coronary angiography, fluorescence endoscopy, laser guided surgery; and performing photoacoustic and sonofluorescent methods.

Specific embodiments to accomplish some of the aforementioned biomedical applications are given below. The inventive dyes are prepared according the methods well known in the art.

In two embodiments, the inventive bioconjugates have the formulas 1 or 2 where W_1 and W_2 may be the same or different and are selected from the group consisting of $-C(CH_3)_2$, $-C((CH_2)_aOH)CH_3$, $-C((CH_2)_aOH)_2$, $-C((CH_2)_aCO_2H)CH_3$, $-C((CH_2)_aCO_2H)_2$, $-C((CH_2)_aNH_2)CH_3$, $-C((CH_2)_aNH_2)_2$, $-C((CH_2)_aNR^{12}R^{13})_2$, $-NR^{12}$, and -S-; Y_1 and Y_2 are selected from the group consisting of hydrogen, tumor-specific agents, -CONH-Bm, -NHCO-Bm, $-(CH_2)_a$-CONH-Bm, $-CH_2-(CH_2OCH_2)_b-CH_2$-CONH-Bm, $-(CH_2)_a$-NHCO-Bm, $-CH_2-(CH_2OCH_2)_b-CH_2$-NHCO-Bm, $-(CH_2)_aNR^{12}R^{13}$, and $-CH_2(CH_2OCH_2)_b-CH_2NR^{12}R^{13}$; Z_1 and Z_2 are independently selected from the group consisting of hydrogen, phototherapy agents, -CONH-Dm, -NHCO-Dm, $-(CH_2)_a$-CONH-Dm, $-CH_2-(CH_2OCH_2)_b-CH_2$-CONH-Dm, $-(CH_2)_a$-NHCO-Dm, $-CH_2-(CH_2OCH_2)_b-CH_2$-NHCO-Dm, $-(CH_2)_a$-N $R^{12}R^{13}$, and $-CH_2(CH_2OCH_2)_b-CH_2N\ R^{12}R^{13}$; K_1 and K_2 are independently selected from the group consisting of C_1-C_{10} alkyl, C_5-C_{20} aryl, C_1-C_{20} alkoxyl, C_1-C_{20} aminoalkyl, $-(CH_2)_a$-CO-, $-(CH_2)_a$-CONH, $-CH_2-(CH_2OCH_2)_b-CH_2$-CONH-, $-(CH_2)_a$-NHCO-, $-CH_2-(CH_2OCH_2)_b-CH_2$-NHCO-, and $-CH_2-(CH_2OCH_2)_b$-CO-; X_1 and X_2 are single bonds, or are independently selected from the group consisting of nitrogen, $-CR^{14}$-, $-CR^{14}R^{15}$, and $-NR^{16}R^{17}$; Q is a single bond or is selected from the group consisting of -O-, -S-, and $-NR^{18}$; a_1

and b_1 independently vary from 0 to 3; Bm is selected from the group consisting of bioactive peptides containing 2 to 30 amino acid units, proteins, antibody fragments, mono- and oligosaccharides; Dm is selected from the group consisting of photosensitizers, photoactive molecules, and phototherapy agents; a and c independently vary from 1 to 20; and b and d independently vary from 1 to 100.

In two other embodiment, the bioconjugates according to the present invention have the formulas 3 or 4 wherein W_1 and W_2 may be the same or different and are selected from the group consisting of $-C(CH_3)_2$, $-C((CH_2)_aOH)CH_3$, $-C((CH_2)_aOH)_2$, $-C((CH_2)_aCO_2H)CH_3$, $-C((CH_2)_aCO_2H)_2$, $-C((CH_2)_aNH_2)CH_3$, $-C((CH_2)_aNH_2)_2$, $-C((CH_2)_aNR^{12}R^{13})_2$, $-NR^{12}$, and -S-; Y_1 and Y_2 are selected from the group consisting of hydrogen, tumor-specific agents, -CONH-Bm, -NHCO-Bm, $-(CH_2)_a$-CONH-Bm, $-CH_2-(CH_2OCH_2)_b-CH_2$-CONH-Bm, $-(CH_2)_a$-NHCO-Bm, $-CH_2-(CH_2OCH_2)_b-CH_2$-NHCO-Bm, $-(CH_2)_a-NR^{12}R^{13}$, and $-CH_2(CH_2OCH_2)_b-CH_2NR^{12}R^{13}$; Z_1 and Z_2 are independently selected from the group consisting of hydrogen, phototherapy agents, -CONH-Dm, -NHCO-Dm, $-(CH_2)_a$-CONH-Dm, $-CH_2-(CH_2OCH_2)_b-CH_2$-CONH-Dm, $-(CH_2)_a$-NHCO-Dm, $-CH_2-(CH_2OCH_2)_b-CH_2$-NHCO-Dm, $-(CH_2)_a-N\ R^{12}R^{13}$, and $-CH_2(CH_2OCH_2)_b-CH_2N\ R^{12}R^{13}$; K_1 and K_2 are independently selected from the group consisting of C_1-C_{10} alkyl, C_5-C_{20} aryl, C_1-C_{20} alkoxyl, C_1-C_{20} aminoalkyl, $-(CH_2)_a$-CO-, $-(CH_2)_a$-CONH, $-CH_2-(CH_2OCH_2)_b-CH_2$-CONH-, $-(CH_2)_a$-NHCO-, $-CH_2-(CH_2OCH_2)_b-CH_2$-NHCO-, and $-CH_2-(CH_2OCH_2)_b$-CO-; X_1 and X_2 are single bonds or are independently selected from the group consisting of nitrogen, $-CR^{14}-$, $-CR^{14}R^{15}$, and $-NR^{16}R^{17}$; A_1 is a single or a double bond; B_1, C_1, and D_1 are independently selected from the group consisting of -O-, -S, $-CR^{11}$, alkyl, NR^{12}, and -C=O; A_1,

B_1, C_1, and D_1 may together form a 6- to 12-membered carbocyclic ring or a 6- to 12-membered heterocyclic ring optionally containing one or more oxygen, nitrogen, or sulfur atoms; a_1 and b_1 independently vary from 0 to 3; Bm is selected from the group consisting of bioactive peptides containing 2 to 30 amino acid units, proteins, antibody fragments, mono- and oligosaccharides; bioactive peptides, protein, and oligosaccharide; Dm is selected from the group consisting of photosensitizers, photoactive molecules, and phototherapy agents; a and c independently vary from 1 to 20; and b and d independently vary from 1 to 100.

In one embodiment of the invention, the dye-biomolecule conjugates are useful for optical tomographic, endoscopic, photoacoustic and sonofluorescent applications for the detection and treatment of tumors and other abnormalities. These methods use light of wavelengths in the region of 300-1300 nm. For example, optical coherence tomography (OCT), also referred to as "optical biopsy," is an optical imaging technique that allows high resolution cross sectional imaging of tissue microstructure. OCT methods use wavelengths of about 1280 nm.

In various aspects of the invention, the dye-biomolecule conjugates are useful for localized therapy for the detection of the presence or absence of tumors and other pathologic tissues by monitoring the blood clearance profile of the conjugates, for laser assisted guided surgery (LAGS) for the detection and treatment of small micrometastases of tumors, e.g., somatostatin subtype 2 (SST-2) positive tumors, upon laparoscopy, and for diagnosis of atherosclerotic plaques and blood clots.